A double-blind, placebo-controlled study of the effects of lidocaine patch therapy on brain activity for spontaneous pain

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INTRODUCTION

- Lidocaine patch therapy has been shown to modulate brain activity associated with the spontaneous pain of post-herpetic neuralgia, osteoarthritis and chronic back pain (Geha et al. 2007, Baliki et al. 2008).
- We are currently conducting a double-blind placebo-controlled study of brain activity for spontaneous pain and its modulation by Lidocaine patch therapy.
- Here we present the results of our analysis of the psychophysical pain data collected pre- and post treatment for Lidocaine and placebo groups.

Results:

- Bars represent mean ±SEM for n=13-15 subjects per condition. *p<0.05, **p<0.01, ***p<0.001 relative to Pre-Treatment baseline.

METHODS

- 30 Chronic back pain patients received Lidoderm treatment (patches of 5% Lidocaine applied to the painful area) or placebo treatment (patches with no Lidocaine) (50% assigned to each condition).
- Continuous ratings of fluctuations in spontaneous pain during fMRI were obtained at (1) pre-treatment baseline, (2) after 6h of treatment, and (3) after 14 days of patch use.
- Outside the scanner, we obtained subjects' ratings on the McGill Pain Questionnaire (MPQ) at all three sessions.
- The effect of treatment condition across the three sessions was analyzed with a repeated-measures ANOVA and post-hoc tests.
- Covariate analysis was performed to determine the contribution of age, gender, pain duration, depression, anxiety and pain intensity (VAS) to the observed effects.

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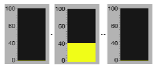
Pain and visual rating tasks

Pain rating task

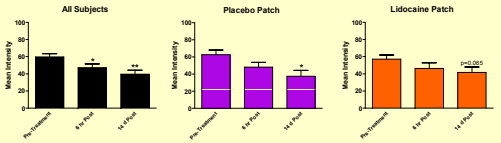
spontaneous pain (CBP)

Visual feedback



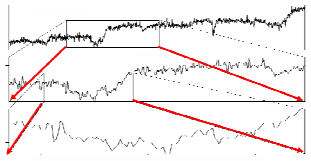
In the **pain rating task**, subjects continuously rate the perceived magnitude (black trace) of pain using a finger-span device. They observe the magnitude of their ratings as a bar graph changing in length in proportion to the ratings.

Mean Intensity of the Spontaneous Pain of CBP



- **Irrespective of treatment condition, there was a significant within-subjects decrease at both 6h and 14d relative to baseline.**
- **At 14d post-treatment, post-hoc analysis showed a significant decrease for the placebo group and a near-significant decrease for the Lidocaine group.**

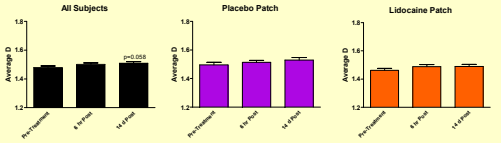
Temporal Dynamics of the Spontaneous Pain of CBP



A Chronic Pain time series is self similar over a range of length scales.

Fractal Dimension D: Probability that the trajectory during a time period will go in the same direction as previous one ("persistent") or the opposite direction ("anti-persistent"). (Foss et al., 2006)

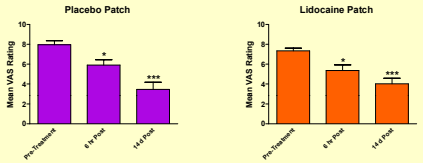
Fractal Dimension of the Spontaneous Pain of CBP



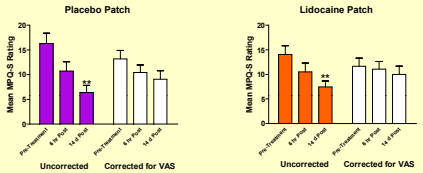
- **Irrespective of treatment condition, there was a near-significant increase in the Fractal Dimension D at 14d relative to pre-treatment.**
- **An increase in D post-treatment indicates that spontaneous pain tends to shift towards a pattern of anti-persistence as a result of treatment.**

Treatment Effects on the Sensory and Affective Dimensions of Pain are Dependent on Intensity Ratings

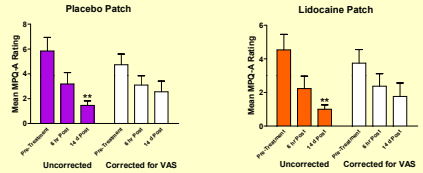
VAS Ratings for the Intensity of CBP



Sensory Pain Ratings for CBP



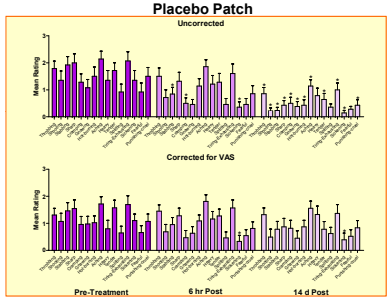
Affective Pain Ratings for CBP



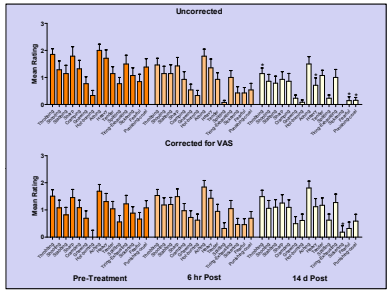
- **For both Lidocaine and placebo treatment groups, there was a significant within-subjects decrease in the mean VAS rating at both 6h and 14d relative to pre-treatment.**
- **Irrespective of treatment condition, sensory and affective MPQ scores were reduced post-treatment. However, these within-subjects effects of test session did not survive following correction for VAS rating.**

Treatment Effects on Pain Qualities are Dependent on Intensity Ratings

Placebo Patch



Lidocaine Patch



- **We observed significant within-subjects decreases for multiple sensory and affective pain qualities.**
- **However, these within-subjects effects of test session did not survive following correction for VAS rating.**

CONCLUSION

Lidocaine and placebo patch therapy were equally effective in reducing pain intensity ratings in CBP patients and had similar effects on the temporal dynamics of the spontaneous pain of CBP.

After correcting for intensity ratings, no significant changes in the sensory and affective qualities of spontaneous CBP were observed due to Lidocaine or Placebo treatment.

We are currently conducting a placebo-controlled imaging study of brain activity for spontaneous CBP and its modulation by Lidocaine patch therapy. The future challenge is whether we can disambiguate the effects of Lidocaine treatment from placebo treatment based on brain activity alone despite their indistinguishable psychophysical effects.

References:

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